A Survey of Invasive Catheter Practices in U.S. Burn Centers

Robert L. Sheridan, MD,*|| Alice N. Neely, PhD,† Mayra A. Castillo, RN, BS,‡ Heather A. Shankowsky, RN,§ Shawn P. Fagan, MD,*|| Kevin K. Chung, MD,‡ Joan M. Weber, RN, BSN, CIC*

Burn-specific guidelines for optimal catheter rotation, catheter type, insertion methods, and catheter site care do not exist, and practices vary widely from one burn unit to another. The purpose of this study was to define current practices and identify areas of practice variation for future clinical investigation. An online survey was sent to the directors of 123 U.S. burn centers. The survey consisted of 23 questions related to specific practices in placement and maintenance of central venous catheters (CVCs), arterial catheters, and peripherally inserted central catheters (PICCs). The overall response rate was 36%; response rate from verified centers was 52%. Geographic representation was wide. CVC and arterial catheter replacement varied from every 3 days (24% of sites) to only for overt infection (24% of sites); 23% of sites did not use the femoral position for CVC placement. Nearly 60% of units used some kind of antiseptic catheter. Physicians inserted the majority of catheters, and 22% of sites used nonphysicians for at least some insertions. Ultrasound was routinely used by less than 50% of units. A wide variety of post-insertion dressing protocols were followed. PICCs were used in some critically injured patients in 37% of units; the majority of these users did not rotate PICCs. Thus, it can be surmised that wide practice variation exists among burn centers with regard to insertion and maintenance of invasive catheters. Areas with particular variability that would be appropriate targets of clinical investigation are line rotation protocols, catheter site care protocols, and use of PICCs in acute burns. (J Burn Care Res 2012;33:741–746)

Central venous catheters (CVCs) and arterial catheters (ACs) provide essential access for critically injured patients. Practices surrounding the insertion and maintenance of these devices have been appropriate targets for numerous guidelines.[1] Practices designed to minimize catheter-related infections were among the first critical care guidelines written.[2] Existing practice guidelines designed to minimize invasive catheter infections and insertion-related complications are widely followed in general adult and pediatric intensive care units. However, burn-care providers view the needs of patients in burn intensive care units as unique.[3] A meta-analysis of CVCs used in burn units demonstrated this wide practice variation.[4] These beliefs are based on the frequent need to place catheters through burn-injured skin and the occurrence of bacteremias related to wound manipulation.[5] Widely accepted burn-specific guidelines for optimal catheter rotation, catheter type, insertion methods, and catheter site care do not exist. The purpose of this study was to define the breadth of current practices and identify areas of practice variation that may be targets for future clinical investigation.

*From the *Shriners Hospitals for Children®—Boston, Massachusetts; †Shriners Hospitals for Children®—Cincinnati, Ohio; ‡US Army Institute of Surgical Research, Fort Sam Houston, Texas; §Firefighters Burn Treatment Unit, University of Alberta Hospital, Edmonton, Canada; and ||Massachusetts General Hospital, Boston.*

The opinions or assertions contained herein are the private views of the authors and are not to be construed as official or as reflecting the views of the Department of the Army or Department of Defense.

Address correspondence to Joan M. Weber, RN, BSN, CIC, Shriners Hospitals for Children, 51 Blossom St, Boston, Massachusetts 02114.

1559-047X/2012

DOI: 10.1097/BCR.0b013e318254d4ab

Methods

An online survey was sent to the directors of 123 U.S. burn centers, whose contact information was obtained from the American Burn Association.

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
01 NOV 2012	**N/A**	**-**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
A Survey of Invasive Catheter Practices in US Burn Centers	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
Sheridan R. L., Neely A. N., Castillo M. A., Shankowsky H. A., Fagan S. P., Chung K. K., Weber J. M.,	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)	8. PERFORMING ORGANIZATION REPORT NUMBER
United States Army Institute of Surgical Research, JBSA Fort Sam Houston, TX	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a REPORT	b ABSTRACT	c THIS PAGE			
unclassified	**unclassified**	**unclassified**	**UU**	**6**	

These centers included both verified and nonverified burn centers. The survey consisted of 23 questions related to specific practices in placement and maintenance of CVCs, ACs, and peripherally inserted central catheters (PICCs).

Results

The response rate was 36% (44 of 123 sites). Of the 58 American Burn Association–verified units, 30 (52%) responded. Of the 65 unverified sites, 14 (22%) responded. Of the 44 burn centers responding, 13% treated only pediatric patients, 27% only adult patients, and 60% treated both adults and children. The mean ± SD number of burn admissions per year was 291 ± 169. Geographic representation was wide and evenly distributed (Figure 1). Functional representation was varied; however, 80% of responses were from dedicated burn units and 15% from mixed burn trauma units (Figure 2). A self-estimated average of 89 patients per year per unit required central venous cannulation (range, 5–500), and a self-estimated average of 60 patients per year per unit required arterial cannulations (range, 6–300).

Findings of particular interest included the following:

- Almost 30% of respondents do not routinely change catheters in the absence of overt signs of infection. The remaining 70% of respondents have highly variable practices, ranging from 3 to 14 days between catheter rotations (Figure 3).
- Almost 40% of respondents use guidewire exchange when rotating catheters at least occasionally (Figure 4).
- Femoral catheters are routinely used by nearly 80% of respondents (Figure 5).

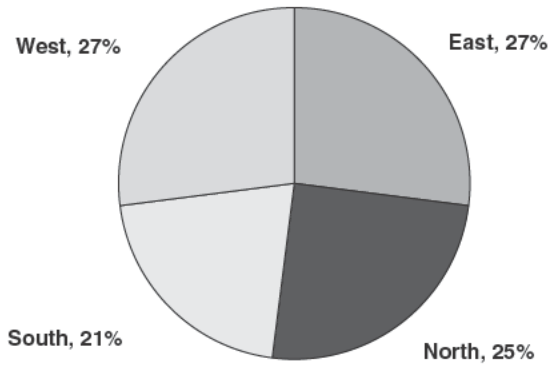

Figure 1. Geographic location of responding units.

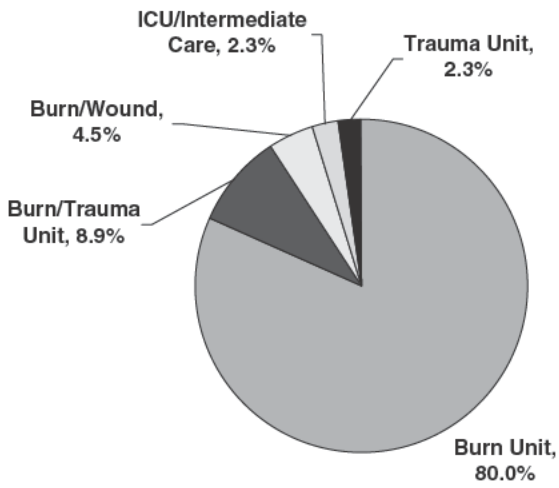

Figure 2. Type of responding unit.

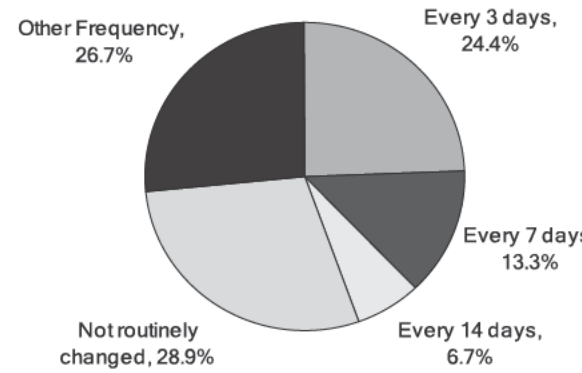

Figure 3. Routine catheter change frequency.

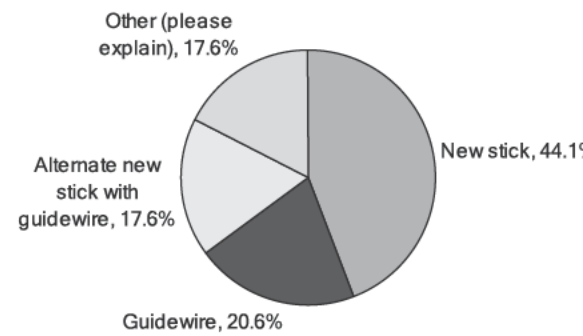

Figure 4. If central venous catheters (CVCs) are routinely changed, how is this done?

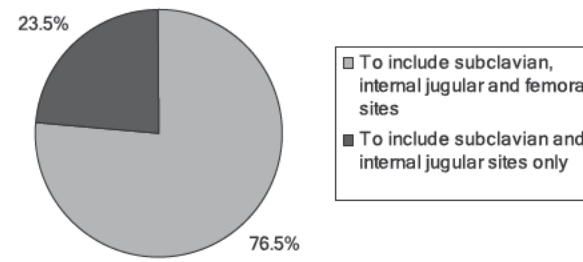

Figure 5. If central venous catheters (CVCs) are routinely changed, sites are rotated.

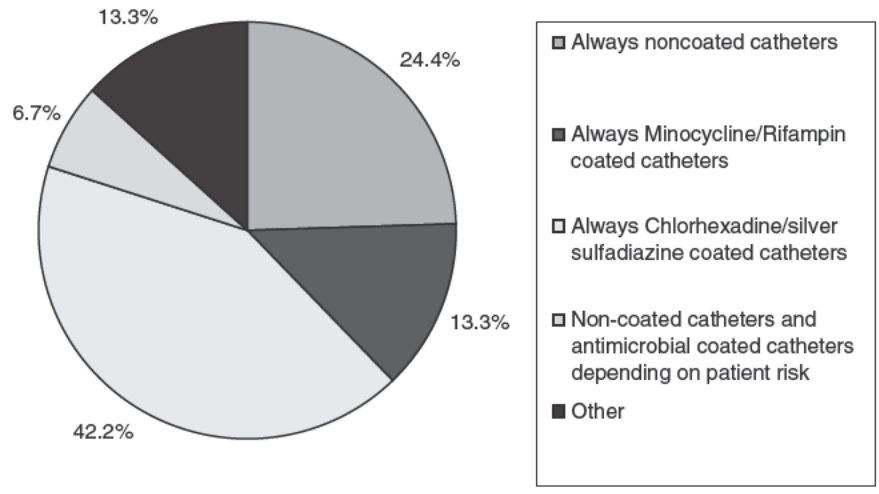

Figure 6. Use of antimicrobial catheters.

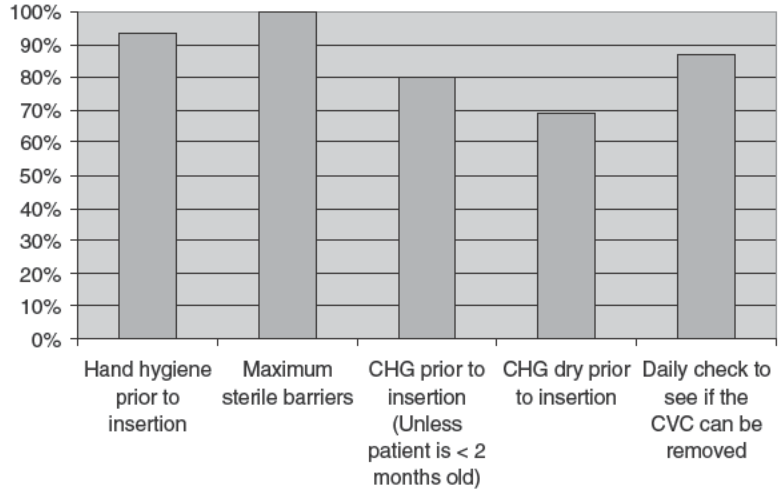

Figure 7. Catheter insertion protocol components. CHG, chlorhexidine gluconate.

- Almost 75% of respondents use antimicrobial catheters routinely, and 55% always use them (Figure 6).
- Catheter change protocols are followed by most units (Figure 7).
- Approximately 71% of catheters are inserted by resident/fellow physicians with or without attending supervision at least some of the time. Approximately 20% of catheters are inserted by nonphysicians with physician supervision (Figure 8).
- Almost all centers place CVCs through the burns if necessary (Figure 9).
- Approximately 60% of respondents do not routinely use ultrasound to facilitate insertion (Figure 10).
- There is a wide variation in catheter site care protocols, with 56% using gauze or semipermeable dressings combined with chlorhexidine gluconate when placed through intact skin. If placed through an open wound, almost 45% use the same care as the surrounding wound (Figures 11 and 12).
- PICCs are used routinely in patients with acute burns by almost 40% of the respondents, and 90% of these providers do not routinely rotate PICCs (Figures 13 and 14).

Nearly 40% of respondents routinely rotate ACs, with most changing every 5 to 7 days. Almost 57% believe that the risk associated with ACs for development of catheter-related bloodstream infection is less than for CVCs (Figures 15 and 16).

DISCUSSION

Standardization of practice in critical care units has been shown to improve care.[6] Numerous examples

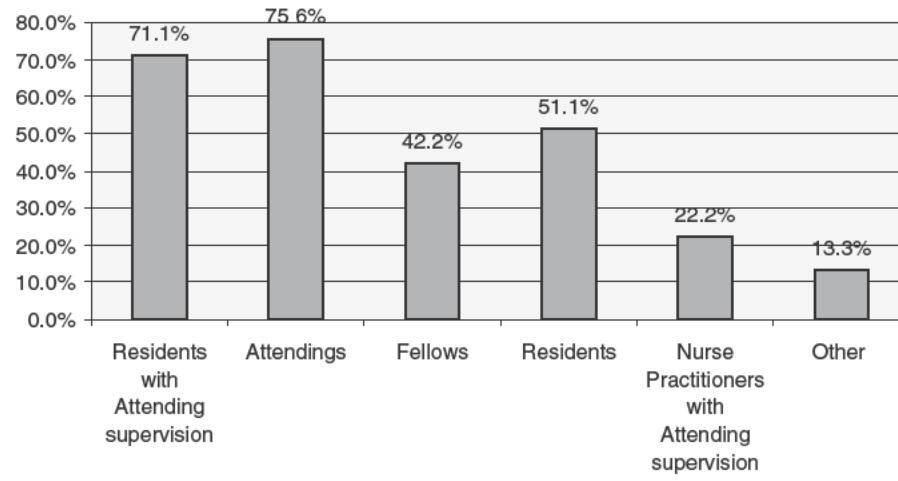

Figure 8. Personnel inserting central venous catheters (CVCs).

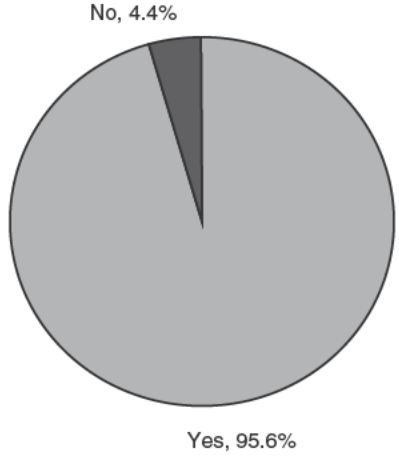

Figure 9. Central venous catheter (CVC) insertion through burn wounds.

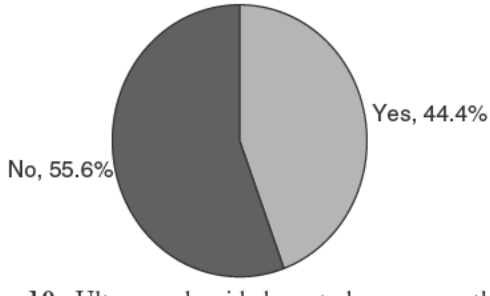

Figure 10. Ultrasound-guided central venous catheter (CVC) insertion.

exist documenting improved outcomes and reduced costs when protocols are developed and their uses documented. Examples include the respiratory bundle,[7] thromboembolism prophylaxis,[8] sedation,[9] and nutritional support.[10] Despite these and other supportive data, general adoption of protocol-driven critical care has not been universally adopted.[11]

Within the burn community, rotation of vascular access devices has been a particular area of controversy. Reflected by our data, line rotation practices vary from every 3 days to rotation only for overt signs of infection. There are data suggesting that CVC sepsis rates begin to rise markedly if catheters are left in place longer than 10 days in burn patients, supporting the concept of rotation earlier than this time point.[12]

The frequency, cost, and potential mechanical and infectious complications associated with vascular access in burn units makes clinical study of these procedures highly attractive in light of the variability in actual practice demonstrated by the data. This survey did not explore in detail questions about specific CVC practices, for example, timing of PICC placement in the burn population. Given the need for administration of a variety of intravenous fluids as well as blood draws from these lines, it is likely that PICCs would not be useful in the early stages of burn resuscitation and care. In addition, until such time as there are adequate, large clinical studies on a variety of questions involving the use of these catheters in the burn population, it is difficult to determine what obstacles there may be to establishment of a more protocolized guideline for the burn population. With the increased emphasis on hospital-specific quality metrics and public disclosure of infection rates, there is an important need for a protocol for CVC use in the burn population.

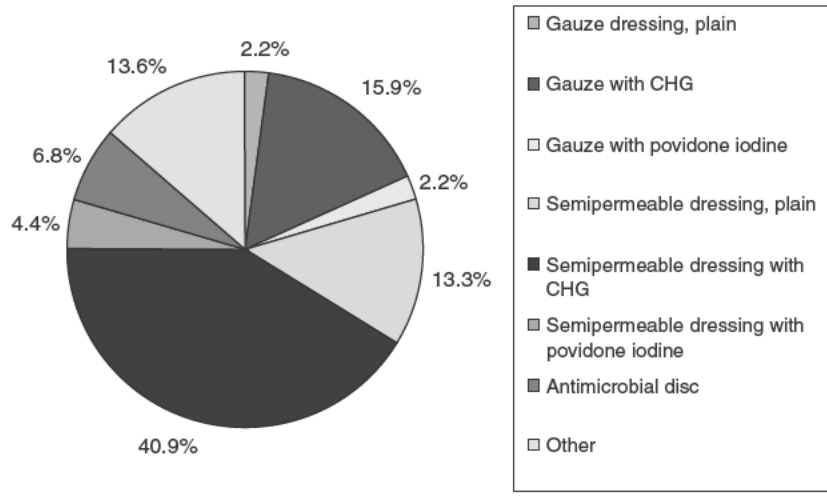

Figure 11. Care of central venous catheter (CVC) insertion site if placed through intact skin. CHG, chlorhexidine gluconate.

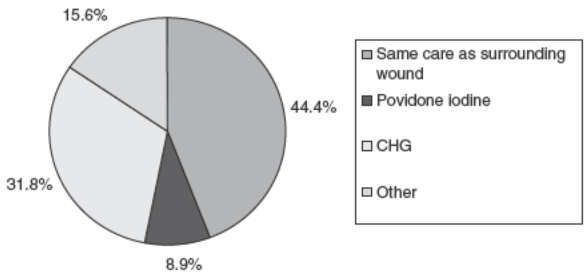

Figure 12. Care of central venous catheter (CVC) site if placed through or near a burn. CHG indicates chlorhexidine gluconate.

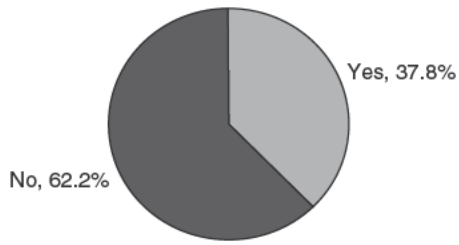

Figure 13. Peripherally inserted central catheter (PICC) use.

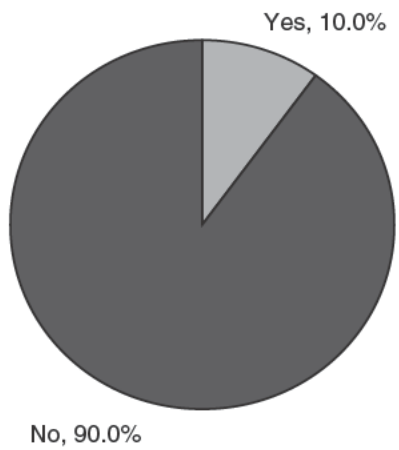

Figure 14. Peripherally inserted central catheter (PICC) management.

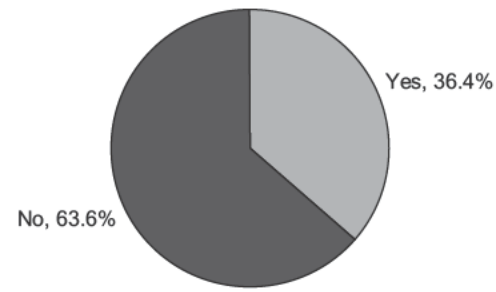

Figure 15. Arterial line changes.

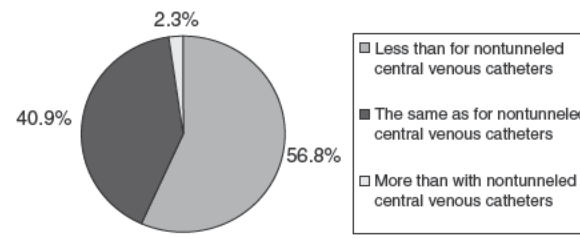

Figure 16. Perceived risk of bloodstream infection from arterial catheters (ACs).

Conclusions

Vascular access, often for prolonged periods and through compromised skin, is absolutely required to manage serious burns successfully. Despite recent emphasis on standardization and protocols in critical care, wide practice variation exists among burn centers with regard to insertion and maintenance of invasive catheters. Areas with particular variability that would be useful targets of clinical investigation are the appropriate role of PICCs, line rotation protocols, impact of antiseptic catheters, and catheter site care protocols.

ACKNOWLEDGMENTS

We thank Otilia Sánchez for editing assistance.

REFERENCES

1. Wheeler DS, Giaccone MJ, Hutchinson N, et al. A hospital-wide quality-improvement collaborative to reduce catheter-associated bloodstream infections. Pediatrics 2011;128:e995–e1004; quiz e1004–7.
2. O'Grady NP, Alexander M, Dellinger EP, et al. Guidelines for the prevention of intravascular catheter-related infections. Centers for Disease Control and Prevention. MMWR Recomm Rep 2002;51(RR-10):1–29.
3. O'Mara MS, Reed NL, Palmieri TL, et al. Central venous catheter infections in burn patients with scheduled catheter exchange and replacement. J Surg Res 2007;142:341–50.
4. Echevarria-Guanilo ME, Ciofi-Silva CL, Canini SR, Farina JA, Rossi LA. Preventing infections due to intravascular catheters in burn victims. Expert Rev Anti Infect Ther 2009;7:1081–6.
5. Sasaki TM, Welch GW, Herndon DN, Kaplan JZ, Lindberg RB, Pruitt BA Jr. Burn wound manipulation-induced bacteremia. J Trauma 1979;19:46–8.
6. Hasibeder WR. Does standardization of critical care work? Curr Opin Crit Care 2010;16:493–8.
7. Stone ME Jr, Snetman D, O' Neill A, et al. Daily multidisciplinary rounds to implement the ventilator bundle decreases ventilator-associated pneumonia in trauma patients: but does it affect outcome? Surg Infect (Larchmt) 2011;12:373–8.
8. Robertson MS, Nichol AD, Higgins AM, et al.; VTE Point Prevalence Investigators for the Australian and New Zealand Intensive Care Research Centre; Australian and New Zealand Intensive Care Society Clinical Trials Group. Venous thromboembolism prophylaxis in the critically ill: a point prevalence survey of current practice in Australian and New Zealand intensive care units. Crit Care Resusc 2010;12:9–15.
9. Jackson DL, Proudfoot CW, Cann KF, et al. A systematic review of the impact of sedation practice in the ICU on resource use, costs and patient safety. Crit Care. 2010;14:R59.
10. Heyland DK, Dhaliwal R, Day A, Jain M, Drover J. Validation of the Canadian clinical practice guidelines for nutrition support in mechanically ventilated, critically ill adult patients: results of a prospective observational study. Crit Care Med 2004;32:2260–6.
11. Mehta S, McCullagh I, Burry L. Current sedation practices: lessons learned from international surveys. Anesthesiol Clin 2011;29:607–24.
12. Sheridan RL, Weber JM. Mechanical and infectious complications of central venous cannulation in children: lessons learned from a 10-year experience placing more than 1000 catheters. J Burn Care Res 2006;27:713–18.